University Center for Mathematical Modeling, Applied Analysis and Computational Mathematics

Semester Seminar, 18th November 2013, 8:00–10:30, Room K6

Schedule

Time	Speaker	Title
8:00		Opening
8:05	Jakub Tichý	Regularity of planar flows for shear-thickening fluids under perfect slip boundary conditions
8:20	Hana Bendová	Quantitative Grothendieck property
8:35	Ivan Soukup	Analysis of a generalized Oldroyd-type model for incompressible non-newtonian viscoelastic fluids
8:50	Marek Netušil	Axial prestretch and circumferential distensibility of abdominal aorta
9:05	Ivana Šebestová	Guaranteed and efficient a posteriori error estimates including algebraic error for diffusion PDEs
9:20	Šimon Axmann	Time-periodic solutions to the compressible Navier-Stokes-Fourier system
9:35	Filip Soudský	Some results in weighted function spaces
9:50	Vojtěch Kulvait	Computer analysis and simulation of strain limiting models with linearized strain
10:05	Martin Franců	A new algorithm for approximating the least concave majorant
10:20		Concluding remarks

Abstracts

Šimon Axmann, Time-periodic solutions to the compressible Navier-Stokes-Fourier system. The Navier-Stokes-Fourier system is a well established model for describing the motion of viscous compressible heat-conducting fluids. We study the existence of weak solutions in time-periodic setting regarding possible pressure dependences. In particular, we will show that we are able to deal with more pressure dependences than in the fully time-dependent case, but less than in the steady case.

Hana Bendová, Quantitative Grothendieck property. A Banach space X is Grothendieck if the weak and the weak* convergence of sequences in the dual space X^* coincide. The space ℓ^∞ is a classical example of a Grothendieck space due to Grothendieck. In my talk I will introduce a quantitative version of the Grothendieck property, I will show a quantitative version of the above-metioned Grothendieck's result and a construction of a Grothendieck space which is not quantitatively Grothendieck.

Martin Franců, A new algorithm for approximating the least concave majorant. A step-by-step algorithm is given to approximate the least concave majorant of a function of one real variable. When the function is a piecewise cubic polynomial the result is exact, up to the error in finding roots of a degree six polynomial. Otherwise, the function may be initially approximated by a clamped cubic spline. In this case, an estimate of the error in the least concave majorant is obtained.

Vojtěch Kulvait, Computer analysis and simulation of strain limiting models with linearized strain. The main goal is to simulate response of the material according to a so called strain limiting model. This model can be used for studying the response of brittle elastic materials. We use the linearized elastic strain tensor and thus the model fits to the context of linearized elasticity. However, the response function describing relationship between linearized elastic strain and Cauchy stress is nonlinear and bounded as a function of the stress. I will present the results concerning numerical analysis of the special V-notch geometry and anti-plane stress setting. Numerical results are obtained by finite element method. The results behave as expected which means that even in the areas with high stress the strain remains bounded.

Marek Netušil, Axial prestretch and circumferential distensibility of abdominal aorta. It is known that elastic arteries are significantly prestretched in axial direction and this property has great influence on the mechanical behavior of an artery during the pressure cycle. Nevertheless, only little attention has been paid to this effect. Our study presents results of a simulation of the inflation-extension behavior. The constitutive parameters and geometries for 17 aortas adopted from the literature were supplemented with initial axial prestretches obtained from the statistics of 365 autopsy measurements. For each aorta, the inflationextension response was calculated three times, with the expected value of the initial prestretch and with the upper and lower confidence limit of the initial prestretch derived from the statistics. This approach enabled age-related trends to be evaluated bearing in mind the uncertainty in the prestretch.

Filip Soudský, Some results in weighted function spaces. We characterize the associated norm of generalized gamma spaces and study the basic functional properties such as normability, absolute continuity of the norm, reflexivity etc.

Ivan Soukup, Analysis of a generalized Oldroyd-type model for incompressible non-newtonian viscoelastic fluids. We will briefly introduce the studied model, summarize our results in analysis of its properties, like existence, uniqueness and regularity. Then we will try to outline the reasons for our choice of conditions imposed on the stress tensor (from a purely analytical point of view). Finally, we also outline some of the methods used in the proofs of properties of the studied model.

Ivana Šebestová, Guaranteed and efficient a posteriori error estimates including algebraic error for diffusion PDEs. We present the generalization of guaranteed and locally efficient a posteriori error estimates based on quasi-equilibration of fluxes reconstruction for diffusion PDEs. The estimation newly involves the algebraic error arising from the inexactness in solving underlying algebraic problem. Such estimates are essential for obtaining reliable and efficient numerical solutions of PDE problems.

Jakub Tichý, Regularity of planar flows for shear-thickening fluids under perfect slip boundary conditions. For evolutionary planar flows of shear-thickening fluids in a bounded domain we prove the existence of a solution with the Hölder continuous velocity gradients and pressure. The problem is equipped with perfect slip boundary conditions. We also show L^q theory result for Stokes system under perfect slip boundary conditions.